

REMARKS

Claims 1-6 are pending in the application. Claims 1 and 2 are rejected. Claims 3 and 4 are objected to but would be allowable if placed in independent form. Claims 5 and 6 are allowed. Applicants have amended claims 1-4 and has added new claims 7 and 8. Claim 1 is amended in order to correct a typographical error and not for purposes of patentability.

Drawings

As a preliminary matter, Applicants note that the Examiner has not provided an indication of the acceptability of the drawings in the Office Action Summary or the accompanying comments. Such indication is respectfully requested.

Claim Rejections - 35 U.S.C. § 102

Claim 1 is rejected under 35 U.S.C. § 102(b) as being anticipated by Anderson (5,051,631). This rejection is traversed for at least the following reasons.

As a preliminary matter, Applicants note that the invention generally concerns a proportional solenoid valve, and specifically concerns the structure in such valve that permits a lower self-induced vibration range of the valve element and improves resistance to oscillation. This advantage is provided by the claimed valve structure, particularly including a drain-side passage formed by exhaust passage holes 15e, whose number is an even number equal to four or more than four and which are arranged at regular intervals at a circumferential direction of the valve seat number. The drain-side passage is provided between a seat portion and a drain port 16c, which communicates with a drain-side passage 15d. The valve seat is formed by a valve seat member 15 in housing 16 and being adapted to receive a ball-shaped valve element 14.

The valve element 14 is normally pressed against the seat portion 15b by the rod 10, under a force supplied by spring 12. Thus, the oil flow path to the drain port 16c is closed. As explained at page 8 of the application, in this position, a high-pressure output is obtained from the output port 16b. When the coil is energized, the rod is displaced against the spring force and the high pressure acts on the valve element 14 so that the valve element is displaced. This permits fluid corresponding to the opening degree of the valve to be output to the drain port 16c,

thereby allowing the pressure output from the output port 16b to be reduced. As explained at page 9, this operation is important in a high pressure environment where oil from a source 21 is pumped 22 into a common input/output passage 15c. The output is directed to a control valve 24.

In short, the purpose of this solenoid valve structure is to regulate the output port fluid pressure in a high pressure environment, where the valve is disposed in a common input/output passage. This feature is enhanced by the use of the exhaust passage holes, 15e, as claimed, which reduce vibration and overcome other identified problems.

Anderson

The Examiner has cited the solenoid valve structure of Anderson, particularly as illustrated in Fig. 7, as being relevant. Indeed, with reference to Figs. 1 and 7, there is disclosed a ball armature 34a that is applied against a seat 112 and is operative to regulate the flow of fluid through passage 62a into a chamber C1 for a drainage to an axial passage 114 and radial passage 116. These passages are disposed in a manner illustrated in Fig. 9 and comprise four more such passages. The operation of the ball armature 34a is under control of a spring 38a and coil 22a.

As explained at col. 5, lines 27-49, the application of current to the coil causes the ball armature 34 to be pulled off the seat, increasing the effected flow area and resulting in a lower chamber pressure in chamber C acting against a spool 90. The function of the four passages 114 is not specifically disclosed but it appears that these exhaust ports are intended to provide a regulated control of the pressure changes in chamber C. In Fig. 11, an orifice 100a (*sic* 101a) is provided at the output of passage 110 and serves to maintain a constant chamber pressure in chamber C, as explained at col. 6, lines 28-41.

In the summary of the effect of Anderson at col. 7, lines 39-50, the patentee states that the valve is more responsive and less subject to inertia and the operation is not adversely affected by the force of any spring in the ball so that higher hydraulic forces can be provided to minimize hysteresis from friction.

Based on the foregoing disclosure, a key distinguishing feature between Anderson and the structure of claim 1 relates to the recited cylindrical valve seat member. In the claim, that

limitation includes an input/output-side passage provided (1) between the input port and the drain port and (2) between the output port and drain port. This definition of structure precludes the intervention of a spool valve, as illustrated in Fig. 1 of Anderson. In other words, the present invention, as illustrated in Fig. 1, is directed to a valve that is placed between a source of high oil pressure 22 and a subsequent control valve 24, in order to regulate the pressure that is being provided to the control valve. This requires a common input/output side passage. By contrast, Anderson is solely concerned with the provision of a release for the pressure in chamber C provided against one end of a spool valve 92. The input port and output port in Anderson are operative solely with respect to the spool valve itself, and not to the passage 62 or chamber C as illustrated in Figs. 1 and 7. Indeed, the only source of fluid to the chamber C is the passage 100. Thus, Applicants respectfully submit that in the absence of such structure, the claim cannot be anticipated.

Moreover, the claimed arrangement would not be obvious from the teachings of Anderson. The claimed structure is totally different as there are different purposes for the solenoid valve. Moreover, the placement of input/output ports in passages 62 or chamber C of Anderson would not be obvious. As already noted, Anderson teaches the use of an orifice 100 that provides fluid through the spool valve into the chamber C. There would be no reason to put additional ports into the chamber C.

Claim Rejections - 35 U.S.C. § 112

Claim 2 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner asserts that claim 2, line 3 should not state “one of” but instead should state “between” or some other expression indicating a range. This rejection is traversed.

Applicants respectfully submit that the claim is intended to identify two different choices, one where the total sectional area is equal to a seat area and the other where the total sectional area is twice as large as the seat area. Thus, this claim is limited to one of two values and nothing in-between. Nonetheless, claim 2 has been amended to simply state that the total sectional area is equal to a seat area and a new claim 7 has been added which states that the total

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sectional area is twice as large as a seat area. Applicants also have added a new claim 8 which states such range.

Allowable Subject Matter

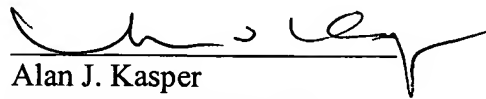
Claims 3-4 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form. Applicants have amended claims 3 and 4 to place them in independent form, as here in the attachment. Allowance of claims 5 and 6 is gratefully acknowledged.

On the basis of the growing arguments and amendments, Applicants respectfully submit that all of the claims should be patentable. Please note that claim 1 has been amended to remedy a typographical error.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,


Alan J. Kasper
Registration No. 25,426

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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